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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,081	12/09/2003	Su-Chen Lai	0941-0873P	2781
2292	7590	09/30/2004	EXAMINER	
BIRCH STEWART KOLASCH & BIRCH PO BOX 747 FALLS CHURCH, VA 22040-0747			KENNEDY, JENNIFER M	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 09/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/730,081

Applicant(s)

LAI, SU-CHEN

Examiner

Jennifer M. Kennedy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 5-8, and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. (U.S. Patent No. 6,716,696).

Chen disclose a method for forming a bottle-shaped trench comprising the steps of:

providing a substrate having a pad structure (102, 104) and at least one trench therein (107, 108);

forming a mask layer (112) to fill the bottom of the trench;

etching the portion of the semiconductor substrate (see column 3, lines 45-50) of the trench which is not covered by the mask layer; and

removing the mask layer to form the bottle-shaped trench (see column 3, lines 30-35).

In re claim 5, Chen et al. disclose the method wherein the semiconductor substrate is etched using $\text{NH}_4\text{OH} + \text{H}_2\text{O}$ to form the bottle-shaped trench (see column 3,

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lines 43-50). The examiner notes that ammonium hydroxide is an aqueous solution of ammonia, and synonyms for ammonium hydroxide are ammonia solution, and dilute ammonia. Chen et al. disclose an aqueous solution of ammonia that they refer to as diluted ammonia and water, and thus teaches $\text{NH}_4\text{OH} + \text{H}_2\text{O}$.

In re claim 6, Chen et al. disclose the method wherein the pad structure comprises a stacked oxide layer and a nitride layer (102, 104).

In re claim 7, Chen et al. disclose the method wherein the masking material is photoresist (112, see column 3, lines 24-30).

In re claim 8, Chen et al. disclose the method wherein the filling of the mask layer in the trench comprises the steps of: coating the pad structure with a masking material to fill the trench; and recessing the masking material to a predetermined depth, thus forming a mask layer in the trench (see column 3, lines 24-30).

In re claim 10, Chen et al. disclose the method wherein the trench has a sidewall with a collar oxide layer (114) at the top trench, and the semiconductor substrate unmasked by the collar oxide layer is etched in the trench (see Figures 7, 8).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,716,696) in view of Heo et al. (U.S. Patent No. 6,398,904)

In re claims 2-4, Chen et al. disclose the method as claimed and rejected above including the wherein the etching of the semiconductor substrate to form a bottle-shaped trench comprises the steps of: filling water in the trench; and diffusing an etchant in the trench by means of water, thereby etching the semiconductor substrate not covered by the masking layer (see column 3, lines 40-45). Chen et al. does not disclose the use of deionized water or immersing the semiconductor substrate in the deionized water and immersing the semiconductor substrate in an etching solution containing the $\text{NH}_4\text{OH}+\text{H}_2\text{O}$ etchant

Heo et al. teaches the use of deionized water and immersing the substrate into the deionized water and etchant (see column 3, lines 4-15). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize deionized water and immerse the substrate into the tank in order to prevent contamination and allow for efficient and precise etching (see Heo et al. column 2, lines 35-42).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,716,696) in view of Lee et al. (U.S. Patent No. 6,426,250).

In re claim 9, Chen et al. disclose the method as claimed and rejected above including the method of removing the photoresist material, but does not disclose the

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method wherein the masking material is removed with a solution comprising a mixture of H_2SO_4 and Hydrogen Peroxide.

Lee et al. disclose the method wherein the masking material is removed with a solution comprising a mixture of H_2SO_4 and Hydrogen Peroxide (see column 5, lines 20-40). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the etching solution of Lee et al., because as Lee et al. teach that the etch chemistry allows for residual pre removal of photoresist.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,716,696).

In re claim 11, Chen et al. disclose the method as claimed and rejected above, but does not disclose the method wherein the depth of the mask layer is defined to about 600nm from the top of the trench. The examiner notes that Applicant does not teach that the depth from the top of the trench solve any stated problem or is for any particular purpose. Therefore, the depth lacks criticality in the claimed invention and does not produce unexpected or novel results. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the resist at any depth from the top of the trench, since the invention would perform equally well when the mask is at different depths to protect the bottom of the trench from etching, and because it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233, MPEP 2144.05 II A. Further, the examiner notes

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that the depth from the top of the trench would be dependent on the total depth of the trench and could be optimized. The examiner notes that the trench of Chen et al. is 6000 nm deep, if in fact, the photoresist were to be defined to 600nm from the top then the photoresist would fill 90% of the trench and the formation of a bottle shaped trench while filled with the resist would be impossible.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (571) 272-1672. The examiner can normally be reached on Mon.-Fri. 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (571) 272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



jmk


Jennifer M. Kennedy
Patent Examiner
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